King, E. M., Cerajewska, T. L., Locke, M., Claydon, N. C. A., Davies, M., & West, N. X. (2018). The Efficacy of Plasma Rich in Growth Factors for the Treatment of Alveolar Osteitis: A Randomized Controlled Trial. *Journal of Oral and Maxillofacial Surgery*. https://doi.org/10.1016/j.joms.2017.12.025

**The efficacy of Plasma Rich in Growth Factors for the treatment of alveolar osteitis: a randomised controlled trial**

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**Abstract**

**Purpose**: To investigate the efficacy of Plasma Rich in Growth Factors (PRGF)® for the treatment of alveolar osteitis compared to a positive control Alvogyl®.

**Methods**: This single centre, single blind, randomised, two treatment, parallel study was conducted in a UK dental hospital. All healthy adults who presented with alveolar osteitis following tooth extraction over a 3 month period were invited to participate. Each socket was randomised and treated with one of two treatment modalities, a test treatment PRGF® or a positive control Alvogyl®. Following treatment, patients were reviewed at 3 and 7 days by a second clinician blinded to the treatment given. Outcome measures included pain, exposed bone, inflammation, halitosis, dysgeusia and quality of life assessment.

**Results**: 38 patients with data from 44 sockets, 22 in the PRGF® group and 22 in the Alvogyl® group, were analysed. The PRGF® group demonstrated significantly faster bone coverage as well as significantly reduced inflammation and halitosis ($p<0.05$) compared to the control group receiving Alvogyl®. There was no significant difference for pain, quality of life measures or dysgeusia between the groups.

**Conclusion**: PRGF® predictably treated alveolar osteitis following tooth extraction compared to the conventional standard treatment of Alvogyl® which has been used for many years. PRGF could be considered as an alternative treatment for alveolar osteitis, and indeed appears to have significant advantages over Alvogel®.

## Introduction

Alveolar osteitis (AO) is a common, painful postoperative complication that can follow tooth extraction. Although it is a self-limiting condition, symptoms can last up to 28 days,[1] therefore following diagnosis immediate treatment should be provided in order to expedite resolution of the condition and improve quality of life during the healing period.

AO is described as being postoperative pain originating from the extraction socket, which peaks at around 1-3 days following tooth extraction and is associated with partial or total loss of the blood clot from the socket, with or without halitosis.[2] The incidence varies from 1-5% for routine dental extractions to around 30% for third molar extractions depending on the degree of tissue trauma caused by tooth extraction,[3] with smoking and poor oral hygiene being purported risk factors.[4] Patients with AO usually seek emergency treatment soon after extraction with almost all presenting within a week complaining of severe pain, halitosis and dysgeusia (bad taste).[2] Treatment, involves some or all of the following: anaesthesia of the socket, debridement, irrigation and placement of a dressing with or without sutures, and evidence shows that patients tend to require multiple appointments before symptoms subside.[5] The obtundant dressing Alvogyl® (Septodont – Maidstone, Kent, UK), is commonly used to treat AO,[6] cases being managed in a similar manner since the 1960s.

Within the National UK Clinical Guidelines for the management of AO provided by the Royal College of Surgeons England 1997, which were reviewed in 2003, the use of an obtundant dressing to pack the socket is advised.[4] The majority of AO cases worldwide are treated with the obtundant dressing Alvogyl® (Septodont – Maidstone, Kent, UK), with active ingredients of eugenol, iodoform and butambem.[6] It is used on a short term basis (up to 9 days) and has been shown to reduce post-operative pain compared to no treatment

controls.[7] However, the presence of Alvogyl® in a healing socket has also been shown to cause a foreign body reaction, delayed healing and prolonged pain (14 days).[8]

Blood derived platelet-rich concentrates are now used widely in dentistry and medicine for tissue regeneration.[9, 10] Plasma Rich in Growth Factors Endoret® (PRGF®) (Biotechnology Institute, San Antonio, Spain) is a leukocyte-free platelet concentrate which has been shown to have tissue regenerating[11, 12] and antimicrobial capabilities.[13, 14] It is used in a wide range of oral surgery procedures to enhance postoperative healing, for example, following implant placement and healing of the maxillary sinus membrane.[15, 16, 17, 18, 19] It has also recently been shown that the occurrence of AO following third molar extraction was reduced in patients treated with PRGF® at the time of surgery as compared to a placebo, and further that pain and healing times were also reduced.[20]

To date only one small study has investigated PRGF® soaked onto Gelfoam® (Pfizer Ltd., Tadworth, Surrey, United Kingdom) for the management of AO, with faster healing times reported compared to zinc oxide eugenol.[21] However, Gelfoam® itself has been shown to delay socket healing compared to no treatment controls.[22] Furthermore, Gelfoam® has shown to increase the incidence of AO compared to no treatment controls when placed in healing extraction sockets.[23] The effect of Gelfoam® on the efficacy of PRGF® for the treatment of AO is not known, but it is likely to have influenced the outcomes of the study by Pal et al.[21] Furthermore, the outcome measures in the study by Pal et al.[21] only included pain and speed of healing, other important outcomes for AO such as exposed bone, halitosis, dysgeusia and quality of life outcomes were not reported.

The ongoing and unpleasant symptoms along with the repeated need to attend for emergency appointments can impact considerably on the quality of life of patients suffering with AO. Furthermore, the time and cost implications of repeat emergency appointments can place

considerable burden on already busy dental services. It is therefore important to investigate other treatment modalities, to improve care and faster healing times.

This aim of this study was to investigate the efficacy of PRGF® for the treatment of alveolar osteitis (AO) in patients following tooth extraction as compared to the efficacy of Alvogyl®, the dressing most frequently used for this purpose,[6] using the outcome measures of pain, exposed bone, inflammation, halitosis, dysgeusia and quality of life measures.

## Methods

### Trial Design

The study was a single centre, single blind, randomised, two treatment, parallel study in patients requiring treatment for AO following a recent dental extraction.

### Participants

Eligible participants were adults aged 18 years or over being diagnosed with AO following tooth extraction by dental clinicians in the Oral surgery Department of the Dental Hospital. All patients attending the hospital with AO over a 3 month period were asked to participate in the study. AO diagnosis was based on patients having pain and exposed bone, if either of these parameters were missing patients were not accepted onto the study. Potential participants were provided with an information sheet about the study and those who agreed to take part gave written consent. Patients who gave consent were assessed for eligibility, exclusion criteria included breast-feeding, bleeding disorders, immunocompromised patients, current or recurrent disease/dental pathology that could affect the assessments, severe or unstable physical or psychiatric illness, allergy/intolerance to study materials and a recent history of alcohol or substance abuse.

Details regarding the patient and the tooth extraction were recorded. These details included smoking status, date of extraction, date of the onset of AO symptoms, reason for tooth extraction, setting of tooth extraction (general dental practice/hospital), method of anaesthesia during tooth extraction and complexity of extraction. Complexity of extraction was classified as: 1) simple forceps extraction, no bone removal required; 2) forceps extraction with minor bone removal/tooth division or 3) complex extraction with flap raised + bone removal required. Periodontal status was also recorded using the Basic Periodontal Examination (BPE) with a World Health Organisation (WHO) probe. If more than one 3 was scored or a 4 in any sextant was recorded, the patient was regarded as having active periodontitis. All eligibility and baseline assessments were conducted by a qualified study dentist.

Study Setting

The study was undertaken at a UK Dental Hospital and ethical approval was awarded by the NHS Research Ethics Committee South West – Exeter (ref 14/SW/1101), and all participants gave informed consent in writing. The study was registered on the ISRCTN registry (ISRCTN31193447) and conducted to Good Clinical Practice Guidelines (Medical Research Council 1998) following the guidelines from the declaration of Helsinki.

Interventions

Eligible patients were randomised to receive either the positive control Alvogyl® or the test treatment PRGF® following a predetermined, computer generated, block randomisation schedule with the unit being the socket. Randomization numbers were assigned by study staff at the study site in ascending numerical order as subjects were determined to be fully eligible

to participate in the study. In all cases treatment involved socket debridment, irrigation and dressing placement under local anaesthetic followed by suturing, using simple interrupted or horizontal mattress 4.0 silk sutures depending on the defect, to help retain the dressing. This treatment regime refected the Royal College of Surgeons and local hospital guidelines with minimal suturing to ensure study products were not lost from treatment sites. No antibiotics were prescribed for any study participant. All initial treatment was conducted by the lead clinician, a qualified dentist. Where the defect was randomised to receive the use of Alvogyl®, the socket was irrigated with sterile saline and packed with approximately 0.20 g of Alvogyl® to fill the defect as per the manufacturer's instructions. For patients who were randomised to receive PRGF®, four 9ml tubes of venous blood containing 3.8% sodium citrate were collected. The blood was centrifuged at 580 g for 8 minutes at room temperature (PRGF® Model System Centrifuge IV®, Biotechnology Institute, San Antonio, Spain) as shown in figure 1. The 2 plasma fractions F1 and F2 were separated using a PRGF® Plasma Transfer Device supplied with the PRGF-Endoret® kit, care was taken not to include leukocytes (the buffy coat) when extracting F2. F1 was poured into a flat glass dish and placed in a Plasmatherm H Oven heated to 37°C for 15 minutes. The F1 clot underwent retraction to produce the F1 membrane and the liquid supernatant. F2 was then activated to induce fibrin clot formation. Before placement of the fibrin clot, PRGF® liquid supernatant was used to irrigate the socket, the F1 membrane was then applied to cover the surgical area and the socket margins were sutured.

Outcome Measures

Exposed alveolar bone, halitosis and dysgeusia were recorded as either present or absent and inflammation was assessed on a scale of 0-3 as detailed in table 1. To assess pain, patients were asked to complete a visual analogue score (VAS) training exercise so that they could

rate their pain using VAS on a 100mm line representing the spectrum of pain from no pain at all, to the worst pain imaginable. All these assessments at the initial treatment appointment were undertaken by the lead clinician prior to randomisation and treatment.

The participants returned to the clinic after approximately 3 days (± day) for a review appointment, and again after approximately 7 days (± day) for review and suture removal. A second clinician, a qualified dentist, who was blinded in regards to the original treatment conducted the review appointments. At both review appointments the assessment of the clinical parameters pain, exposed alveolar bone, halitosis, dysgeusia and inflammation were repeated as described above. In addition, at each review appointment patients were asked to rate their swelling, bruising, bleeding and speed of healing by VAS. The lead clinician and second clinician were calibrated for halitosis scoring prior to the start of the study with a Kappa score of p=0.78 .If the patients needed to take analgesics after the placement of the dressing they were excluded from the study.

Statistical Methods

No previous clinical trial has compared the effect of PRGF® versus Alvogyl® in the management of AO. However, Alvogyl® had been examined for efficacy in the management of AO in a clinical trial by Kaya et al.[24] The data obtained by Kaya et al.[24] was used as a reference to calculate the statistical power in the current study. It was assumed that a sample size of 40 sockets (20 per each group), with a standard deviation of 2 and a decrease in pain of 6 points in the VAS would give a statistical power of 86.9%. Therefore, the aim was to recruit 20 sockets per group with the expectation that obtaining data from 17 per group would give a statistical power of 80% with the p value set at 0.05.

For the analysis of statistical difference between continuous variables, a normality test (Shapiro Wilk test) was performed to determine whether the statistical test applied should be

parametric or non-parametric. For normally distributed continuous data Student t-test analyses were performed and for non normal distributions the Mann– Whitney U test was used. Log-linear analyses were performed where the relationship between more than two categorical variables was analysed. Where only two discrete categorical variables existed, Chi-squared analysis was performed to investigate whether the distributions of categorical variables differed from one another.

The statistical significance was set at p-value $\leq 0.05$. All the statistical analyses were performed using the SPSS v15.0 for Windows statistical software package (SPSS Inc., Chicago, IL, USA). Statisticians at Bristol University performed the statistical analysis.

**Results**

Recruitment

38 patients, 20 males and 18 females, were enrolled in the study which ran from beginning of December 2014 to the end of February 2015. 33 patients presented with 1 AO socket, 4 patients presented with 2 AO sockets and 1 patient presented with 3 AO sockets. In total 44 AO sockets were treated on the trial. The average time between tooth extraction and the onset of AO was 2 days. 22 sockets were randomised to receive Alvogyl® and 22 sockets were randomised to receive PRGF®. The socket randomisation schedule resulted in four of the five patients with more than one AO, receiving one of each of the treatments. One patient failed to attend their first review appointment and another patient failed to attend their second review appointment. The data from the review appointments when the patients did attend was included in the statistical analysis. All patients responded to treatment after 7 days and were discharged. There were no complications or adverse events related to either treatment during the study period and all AO's resolved by day 7 of the study.

Baseline

There were no significant differences found between treatment groups with regards to age, race or gender (table 2). Similarly, no significant differences were identified comparing time period before the onset of AO symptoms the method of anaesthesia, tooth type extracted (incisor/premolar/molar), complexity of extraction or reason for extraction between groups. BPE results from all patients showed only 3 out of 38 patients had active periodontal disease. In addition, no significant differences were detected between the Alvogyl® and the PRGF® group with regards to the number of days elapsed prior to the first or second review appointment. However there were significantly more smokers randomised to the Alvogyl® treatment group.

Outcomes

In both treatment groups all clinical outcome measures improved during the course of the study (tables 3 and 4). For patients treated with PRGF®, improvements were progressive for all measures, the best outcomes being observed at the second review appointment. By contrast, in the group treated with Alvogyl®, the amount of bone exposure and the number of patients with halitosis were lower at the first review than at the second review. Significant differences in several clinical outcomes were identified between the groups following treatment with Alvogyl® or PRGF®. By the second review appointment there was significantly less exposed bone and fewer patients with halitosis in the PRGF® group as compared to the Alvogyl® group. Similarly, at the second review clinical inflammation was significantly lower in patients in the PRGF® group compared to the Alvogyl® group. These differences were not significant at the initial treatment or first review appointment. Results for the 4 patients who had 2 or more AO and received both treatments supported these findings, with exposed bone scores and inflammation scores lower in the sockets treated with

PRGF® than in the sockets treated with Alvogyl®. No significant differences between the groups for dysgeusia were observed at any appointment, although for this measure, 2 of the 4 patients receiving both treatments reported dysgeusia in the socket treated with PRGF® only.

For both treatment groups, patient reported pain outcomes as scored by VAS improved progressively from screening to the second review appointment. Similarly, patient reported QoL outcomes as scored by VAS (speed of healing, swelling, bleeding and bruising) improved from the review appointment at 3 days to the review appointment at 7 days (table 4). No significant differences between treatment groups for any patient reported QoL measurement were detected between groups at either review appointment.

Significantly more smokers were randomised to the Alvogyl® group than to the PRGF® group. As a result of the differences in smoking status between groups, the results were first analysed including smokers as presented above, and secondly excluding smokers. The results differed in just one outcome measure when smokers were excluded, patient reported bleeding scores being significantly higher at the second review in the Alvogyl® group ($p<0.05$) as compared to the PRGF® group. Consequently, the data including smokers is presented.

**Discussion**

The purpose of this study was to compare the efficacy of PRGF® with the positive control Alvogyl® for the treatment of AO using pain, exposed bone, inflammation, halitosis, dysgeusia and quality of life as outcome measures. As patients who seek treatment for AO are in severe pain,[3] no negative control was used in this trial as it was deemed unethical to leave patients with an untreated pain condition during the investigation.

This study demonstrated that there was significantly less exposed bone at the second review in the PRGF® group compared to the Alvogyl® group, with similar results obtained whether

smokers were included or not. These results suggest that PRGF® caused less inflammation than Alvogel® resulting in improved healing and better bone coverage over the course of the study with PFRG®. Alternatively Alvogyl® may have been lost from the socket more easily than PRGF®. The data collected supports both theories, firstly greater bone exposure was observed in the Alvogyl® group at the second review as compared to the first review appointment. Secondly, analysing the inflammation data confirmed that there was significantly more inflammation in the Alvogyl® group at the second review than the first, suggesting that this may have been a factor in the reduced healing observed. As there was no untreated control group, whether this difference was due to PRGF® suppressing inflammation or Alvogyl® promoting it cannot be determined. Other studies have reported faster epithelialisation when using PRGF® of AO in extraction sockets,[11, 19, 21] therefore it is possible that the improved bone coverage observed in the PRGF® group in this trial was a result of faster epithelialisation. The positive findings for PRGF® with respect to healing also lend support to those studies that have demonstrated that it appears to reduce the incidence of AO if applied following extraction. [19, 20]

Considering Alvogyl® is widely used as a dressing to treat AO, relatively few studies have investigated soft tissue healing following placement of Alvogyl® in post-extraction or AO sockets. However, in a randomised controlled trial (RCT) that compared the efficacy of Alvogyl®, SaliCept Patch®, low-level laser therapy and no treatment controls in the management of AO it was demonstrated that exposed bone present at 3 days and 7 days following treatment was 34.6% and 3.8% respectively.[24] Similarly, in a double blind RCT comparing Neocone®, Alvogyl® and zinc oxide eugenol packing for the treatment of AO it was demonstrated that in the Alvogyl® group the percentage of patients with exposed bone at 3 days and 7 days were 52.65% and 10.52% respectively.[25] In contrast to these studies, in the present study the levels of exposed bone in the Alvogyl® group increased between the first

and second review from 9.1 to 22.7%. In the study by Kaya et al.,[24] the curettage, irrigation and dressing placement was repeated at 3 days and in the study by Faizel et al.[25] it was replaced if necessary, when pain was persistent. In the present study the dressing was sutured in place which might have aided retention of the dressing. Dressings were not replaced at 3 days reflecting normal practice where they are only changed if pain is persistent.

In the current study significantly reduced inflammation was observed by the second review in the PRGF® group as compared to the Alvogyl® group, reduced inflammation was also observed in the PRGF® as compared to Alvogyl® sites in 3 out of the 4 participants who received both treatments at both review appointments. The only other study investigating PRGF® for the healing of AO sockets used PRGF® soaked gelatin sponge, eugenol and no treatment controls. This study also demonstrated significantly better soft tissue healing with PRGF® at 7 days,[21] while, in a study which examined the healing of extraction sockets, significantly reduced swelling up to 7 days was observed in PRGF® treated as compared to control sites. This study also examined the levels of inflammatory molecules and concluded that while PRGF® induced both pro-and anti-inflammatory moleclues, the anti-inflammatory cytokines could inhibit the pro-inflammatory activities and promote healing.[26] It is possible, therefore that the significantly lower level of inflammation observed by the PRGF® group as compared to the Alvogyl® group in the present study was due to an anti-inflammatory effect of PRGF rather than an inflammatory effect of Alvogyl®.

It is widely agreed that AO is often accompanied by halitosis (oral malodour) which occurs as a result of collection of food debris and colonisation of anaerobic bacteria that produce volatile sulphur compounds,[27] with studies reporting an incidence of between 33.3-76%.[24, 28] In the present study halitosis reduced by approximately 10% in both treatment groups by the first review, however, by the second review the percentage increased in the Alvogyl® group

but continued to decrease in the PRGF® group resulting in a significant difference between them. The debridement and irrigation of AO sockets, together with the placement of a dressing/barrier to food debris alone may be enough to improve halitosis immediately after surgery. At the later timepoint the significant difference may reflect the improved bone coverage in the PRGF® group, as compared to the Alvogyl® group, resulting in a reduced potential for food and debris packing. Alternatively, the reduction in halitosis scores could be due to the antimicrobial effect of PRGF® being greater than that of Alvogyl®. PRGF® has been shown to have antibacterial effects on *Staphylococcus aureus* and *Staphylococcus epidermidis* strains,[13, 14] effects that may be mediated by the platelets which have been shown to have many functions in the antimicrobial host defence systems.[29] By contrast, Alvogyl® contains the antiseptic iodoform which has been shown to have an antibacterial effect on several strains of oral bacteria.[30] In the present study the increase in the numbers of patients with halitosis in the Alvogyl® group could reflect a decline in antimicrobial effects of the dressing, but perhaps also may reflect the potential that there was an increased accumulation of oral debris and bacteria due to dressing loss. The data obtained in the present study is in contrast to the findings of Kaya et al.[24] who observed a progressive decline in halitosis over 7 days following treatment with Alvogyl®. However, as indicated above, curettage and irrigation of the AO sockets was repeated at 3 days in the study by Kaya et al.,[24] and bone coverage increased progressively.

Halitosis is considered an important outcome measure for AO treatment, however measuring halitosis is clinically difficult. In the present study organoleptic assessment was used to detect halitosis. Although organoleptic testing is the gold standard for detecting the presence of halitosis,[31] it is subjective can be a source of inter-examiner bias. In order to reduce bias in this investigation, both examiners were calibrated in detecting and recording halitosis at the beginning of the study.

In the present study the VAS scale which has been shown to be accurate for recording oral pain[32, 33] was used to measure pain as well as patient perception of the quality of life measures of bleeding, swelling, speed of healing and bruising. Pain scores reduced progressively for both Alvogyl® and PRGF® treatment groups throughout the study with no significant differences between treatment groups. Alvogyl® contains the analgesics butamben and eugenol and has been shown to effectively reduce AO pain in a number of studies.[25, 34, 35] By contrast, PRGF® does not contain analgesic constituents however, in a split-mouth RCT, PRGF® improved postoperative pain following tooth extraction as compared to placebo control and it was suggested this was a consequence of improved healing due to the release of growth factors and clot stability.[20] Furthermore, platelet concentrates have shown to be effective at reducing inflammation[36] and as pain is a symptom of inflammation, eradicating inflammation leads to a reduction in pain severity. It is therefore possible that the anti-inflammatory properties of PRGF® contributed to reduced postoperative pain in this trial.

Dysgeusia is also caused by impaction of food debris and the accumulation of anaerobic bacteria. All patients within this study complained of dysgeusia at the screening appointment, and although there was a reduction in reporting of dysgeusia in both groups throughout the study, there was no significant difference between groups. In a study where platelet-rich plasma (cPRP) was used to treat extraction sockets there was also a positive effect on dysgeusia as compared to no-treatment controls.[37] Taken together this data suggests that dressing of extraction sockets may be beneficial in reducing dysgeusia, and this may be a result of the dressing material reducing the extent of debris accumulation and resultant bacterial proliferation.

Interestingly, although clinical signs of increased bone coverage, resolution of inflammation and halitosis were significantly better in the PRGF® group compared to the Alvogyl® group, patients' perception of swelling, bleeding, bruising and speed of healing was similar between groups, with all measures improving from day 3 to day 7. It is possible that pain reduction is the predominant clinical sign that patients' associate with healing which could explain why pain scores correlated more closely with the other patient reported outcomes than with the clinician reported data. Patient reported outcomes, while difficult to measure, are important as ultimately it is the patient who must be satisfied with the treatment outcome.

As with all studies, certain limitations were recognised in the methodology of this investigation which may have had an influence on the overall results. Analysis of the randomisation revealed more smokers were randomised to the Alvogyl® group than the PRGF® group, therefore results were analysed both including and excluding smokers. Interestingly the results were similar whether smokers were included or not. This finding was somewhat surprising as in periodontal disease smoking has been shown compromise healing following treatment[38], however to date there little literature regarding the effect of smoking on the healing of dry socket and this warrants further investigation.

No significant differences were identified comparing method of anesthesia, tooth type extracted, complexity or reasons for of extraction in the two groups. These are interesting findings as this is not the case reviewing the literature. Further, periodontal examination results showed only 3 out of 38 patients had active periodontal disease, which again is as odds with literature. One can argue the number of case in this study are low however, it is of particular interest that the cases of AO presenting were rarely smokers and had minimal periodontal disease and generally good oral health. This is worthy of further research as it contrasts sharply with the traditional literature.

In Conclusion, the results of this study suggest that PRGF® predictably treats alveolar osteitis following tooth extraction compared to standard UK guidance and protocols. PRGF® appears to be more beneficial than Alvogyl® for the treatment of alveolar osteitis with regards to reducing exposed bone, inflammation and halitosis. PRGF® and Alvogyl® are equally effective at reducing postoperative pain following treatment of alveolar osteitis and no difference in patients' measurable quality of life parameters could be distinguished. PRGF could be used as an alterative treatment for AO and specifically for cases of iodine allergy. To confirm these findings, further evaluation of the efficacy of PRGF® over a longer time period with more patients is required together with cost, time and patient quality of life implications to confirm whether the use of PRGF® could be introduced as the new standard guidance.

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**Acknowledgements**

The PRGF® consumables used in this study were supplied by the BTI Biotechnology Institute, Spain.

Table 1: Assessment of Inflammation at treatment and review appointments

| Clinical Parameter | Method of assessment |
|---|---|
| Inflammation | 0 Absence<br>1 – Slight swelling and hardness<br>2 – Fascial planes blurring without affectation of nasolabial folds or eyes<br>3 – Fascial planes blurring with affectation of nasolabial folds and eyes |

Table 2: Baseline demographic and smoking status data for Alvogyl® and PRGF® groups.

| **Baseline Data** | **All** | **Alvogyl® (n=22)** | **PRGF® (n=22)** | **P < 0.05** |
|---|---|---|---|---|
| **Age (years)** | 40.7 ± 17.3 | 39.4 ± 16.9 | 41.1 ± 17.9 | NS[a] |
| **Gender** | | | | |
| Female | 20 | 9 | 11 | NS[b] |
| Male | 24 | 13 | 11 | |
| **Race** | | | | |
| Caucasian | 39 | 20 | 19 | |
| Black | 3 | 2 | 1 | NS[c] |
| Asian | 2 | 0 | 2 | |
| Hispanic | 1 | 0 | 1 | |
| **Smoking status** | | | | |
| Smokers | 13 | 11 | 2 | $p<0.05$[b] |
| Non Smokers | 31 | 11 | 20 | |
| **Smoking (years)** | 26.3 ± 15.5 | 12.8 ± 17.3 | 2.7 ± 9.4 | $p<0.05$[d] |
| **Cigarettes/day** | 11.5 ± 5.7 | 5.6 ± 6.8 | 1.1 ± 18.8 | $p<0.05$[d] |
| **Onset of symptoms (days)** | 2 ± 1 | 2.1 ± 1.3 | 2.0 ± 1.7 | NS[d] |
| **Type of anaesthesia for tooth extraction** | | | | NS[c] |
| Local | 35 | 18 | 17 | |
| Sedation + Local | 7 | 3 | 4 | |
| General | 2 | 1 | 1 | |
| **Tooth type** | | | | NS[c] |

| | | | | |
|---|---|---|---|---|
| Anterior | 3 | 1 | 2 | |
| Premolar | 4 | 0 | 4 | |
| Molar | 37 | 21 | 16 | |
| **Reason for Extraction** | | | | |
| Caries (Unrestorable) | 17 | 8 | 9 | |
| Pericoronitis | 8 | 3 | 5 | |
| Impacted tooth | 5 | 3 | 2 | |
| Periapical periodontitis | 6 | 4 | 2 | NS[c] |
| Abscess | 4 | 1 | 3 | |
| Irreversible pulpitis | 2 | 1 | 1 | |
| Pre-OMFS* surgery | 1 | 1 | 0 | |
| Unknown | 1 | 1 | 0 | |
| **Complexity of extraction** | | | | |
| Difficulty 1 | 16 | 8 | 8 | |
| Difficulty 2 | 10 | 6 | 4 | NS[d] |
| Difficulty 3 | 9 | 4 | 5 | |
| No radiograph available | 7 | 5 | 2 | |

Analysed using a: student t-test; b: chi-squared test; c: loglinear analysis and d: Mann-Whitney test. NS = not significant

Table 3: Differences in clinical scores between Alvogyl® and PRGF® treatments.

| Clinical parameter | Appointment | Alvogyl® (n=22) | PRGF® (n=22) | p-value |
|---|---|---|---|---|
| Inflammation clinical scoring (0-3) | Screening | 2.24 ± 0.5 | 2.52 ± 0.5 | NS |
| | 1st review | 1.33 ± 0.7 | 0.95 ± 0.8 | NS |
| | 2nd review | 1.19 ± 0.8 | 0.67 ± 0.7 | p<0.05 |
| Exposed Bone (% of patients) (present/absent) | Screening | 100 | 100 | NS |
| | 1st review | 9.1 | 9.1 | NS |
| | 2nd review | 22.7 | 0 | p<0.05 |
| Halitosis (% of patients) (present/absent) | Screening | 100 | 100 | NS |
| | 1st review | 40.9 | 33.3 | NS |
| | 2nd review | 42.9 | 9.1 | p<0.05 |
| Dysgeusia (% of patients) (present/absent) | Screening | 100 | 100 | NS |
| | 1st review | 68.2 | 47.6 | NS |
| | 2nd review | 42.9 | 27.3 | NS |

NS = not significant.

Table 4: Differences in quality of life parameters between Alvogyl® and PRGF® treatments as determined by VAS.

| Quality of Life Parameter VAS score (cm) | Appointment | Alvogyl® (n=22) | PRGF® (n=22) | p<value |
|---|---|---|---|---|
| Pain | Screening | 6.6 ± 2.3 | 6.4 ± 1.8 | NS |
| | 1st review | 4.3 ± 2.9 | 4.0 ± 2.7 | NS |
| | 2nd review | 2.4 ± 2.6 | 2.0 ± 2.0 | NS |
| Swelling | 1st review | 2.9 ± 2.7 | 2.3 ± 2.3 | NS |
| | 2nd review | 1.8 ± 1.8 | 1.2 ± 1.7 | NS |
| Bleeding | 1st review | 1.3 ± 1.7 | 0.9 ± 1.2 | NS |
| | 2nd review | 0.7 ± 0.8 | 0.4 ± 0.6 | NS |
| Bruising | 1st review | 1.5 ± 2.3 | 1.7 ± 2.4 | NS |
| | 2nd review | 1.2 ± 1.7 | 1.3 ± 2.3 | NS |
| Healing | 1st review | 5.4 ± 2.9 | 5.6 ± 2.1 | NS |
| | 2nd review | 5.6 ± 2.9 | 6.7 ± 2.7 | NS |

NS = not significant

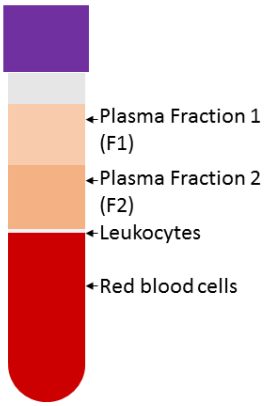


Figure 1: Plasma fractions obtained after centrifugation of whole blood